

# STUDIES ON THE FIELD PERFORMANCE OF TRUE POTATO SEED OF DIFFERENT ENTRIES UNDER TELANGANA CONDITIONS

## ABSTRACT

The quality of seedlings obtained from a nursery influence re-establishment in the field and the eventual production of crops. The present investigation was conducted for two consecutive seasons during *rabi*, 2021-22 and *rabi*, 2022-23 at Mulugu, Sri Konda Laxman Telangana State Horticultural University for evaluation of the field performance of true potato seed. The same seedling raised media showed better performance in the main field of experiment, among the treatments, T<sub>1</sub>.ie KP-15C3 X D-150 + Cocopeat : Vermicompost : FYM (2:1:1) was recorded the significantly highest growth parameters like plant height (25.15 cm and 47.61 cm), number of compound leaves per plant (15.05 and 28.13), leaf length (8.85 cm and 20.13 cm), leaf width (6.68 cm and 14.23 cm), leaf area (27.94 cm<sup>2</sup> and 51.48 cm<sup>2</sup>) and stem diameter (0.60 cm and 0.82 cm) at 30 and 60 DAP respectively. Results related to yield attributing characters like number of micro tubers per plant (11.77), fresh weight of micro tubers per plant (16.21 g), number of small tubers per plant (7.46), fresh weight of small tubers per plant (44.03 g), number of medium tubers per plant (5.89), fresh weight of medium tubers per plant (171.40 g), number of large tubers per plant (2.84), fresh weight of large tubers per plant (115.28 g), total number of tubers per plant (27.95), tuber yield per plant (346.92 g), tuber yield per plot (20.82 kg/ 6 m<sup>2</sup>) and tuber yield (34.69 t/ha) was maximum in T<sub>1</sub> treatment. It concluded that successfully tuberlets yield can be produced from seedling raised from TPS method.

**Key words:** True potato seed, cocopeat, vermicompost, FYM, growth, yield

## INTRODUCTION

Potato (*Solanum tuberosum* L.) is a popular tuber crop that contributes to global food security (Karam *et al.*, 2009). Potato is a wholesome food that belongs to the family Solanaceae. It was originated in Peru Bolivia in the Andes (South America) with the fundamental chromosome number (x=12) (Hawkes, 1990). The potato was introduced to India by Portuguese traders in the 17<sup>th</sup> century and its cultivation was spread to North India by the British (Nath *et al.*, 2008). For the inhabitants of Peru, the potato has been the bread of life for centuries. It is the fourth most important food crop after wheat, rice and maize in terms of food security, nutrition and avoiding hunger where food is always in short supply to support an ever-increasing population amidst inevitable social and political turmoil (Dev *et al.*, 2020).

Farmers traditionally propagate potato through seed tubers (Struik and Lommen, 1990) which are frequently imported from developed seed producing countries and are expensive. These seed tubers are usually bulky, perishable and difficult to transport to remote production sites accounting for more than half the total production cost (Mahmood, 2005). Moreover, tubers are often the main carrier of diseases and pests (Simmonds, 1997) that are attributed to seed degeneration (Gildemacher *et al.*, 2007) which leads to lower yields and tuber quality considerably. The poor quality

seed potato is believed to be one of the major factors contributing to low potato yield (Fuglie, 2007). This has been accelerated by the informal seed distribution system prevailing in most developing countries accounting for more than 90 percent of the seed tuber used by small holder farmers (Hidalgo *et al.*, 2009 and Lungahoet *et al.*, 2010).

True potato seed (TPS) has been suggested as an alternative seed source for potato production, particularly where the use of conventional seed tubers is hampered by large storage losses (Hoang *et al.*, 1988) or infestation with tuber transmitted diseases (Bofuet *et al.*, 1987 and Fernandez *et al.*, 1988) because TPS carries few pathogens especially viruses from season to season (Burrows and Zitter, 2005). In the conventional method, 3.5 tonnes of bulky tuber seeds are required to plant one hectare of the potato crop, but 100 to 125 g of TPS fulfills the same requirements (Thakur *et al.*, 2008, Nizamuddin *et al.*, 2010 and Mihaela *et al.*, 2012). The use of true potato seed (TPS) has many advantages over the use of seed tubers and is attractive for small scale farmers in developing countries (Almekinders *et al.*, 2009 and Ciolocaet *et al.*, 2012). It includes the small mass of seed required to sow, transportation and storage of TPS is safe, easy and inexpensive, long-term TPS seed storage, low seed costs and most seed-borne diseases are not transmitted through the true potato seed (Rowell *et al.*, 1986) and reduces production cost (Accatino and Malagamba, 1982).

The productivity of potato in Telangana State is higher than the national average potato productivity and also potato growing states which indicate the potential scope for increasing the thrust on potato cultivation in Telangana State. However, the farmers are facing certain problems in the acquisition of seed tubers and non availability of location specific suitable varieties adaptable to local conditions, research is lacking on the location specific technologies suitable for the region. Keeping this in mind the current research work has been formulated with “Studies on the field performance of true potato seed of different entries under Telangana conditions.”

## MATERIAL AND METHODS

The field experiment was conducted at the PG research farm, Sri Konda Laxman Telangana State Horticultural University, Mulugu, Siddipet district, Telangana. The experimental site is located at a latitude of 17°43'02" N and a longitude of 78°37'34" E. The soil was well drained sandy loam having pH 7.85, organic carbon 0.89 % and available N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O were 143.26 kg ha<sup>-1</sup>, 26.00 kg ha<sup>-1</sup> and 265 kg ha<sup>-1</sup> respectively. The top 12 best treatments from the nursery experiment of true potato seed (TPS) have been selected based on seedling length and number of true leaves per seedling at transplant stage and it has been used as planting material in field experiment for further yield evaluation. The experiment was laid out in Randomized Block Design (RBD) with two replications. The whole experiment consist of twelve best treatments *i.e.* T<sub>1</sub>: {KP-15C3 X D-150 + Cocopeat : Vermicompost : FYM (2:1:1)}, T<sub>2</sub>: {PSL/76-6 X D-150 + Cocopeat : Vermicompost : FYM (2:1:1)}, T<sub>3</sub>: {PRT-17A X D-150 + Cocopeat : Vermicompost : FYM (2:1:1)}, T<sub>4</sub>: {KP-15C3 X D-150 + Cocopeat : FYM (1:1)}, T<sub>5</sub>: {PSL/76-6 X D-150 + Cocopeat : FYM (1:1)}, T<sub>6</sub>: {PRT-17A X D-150 + Cocopeat : FYM (1:1)}, T<sub>7</sub>: {KP-15C3 X D-150 + Cocopeat : Vermicompost (1:1)}, T<sub>8</sub>: {PSL/76-6 X D-150 + Cocopeat : Vermicompost (1:1)}, T<sub>9</sub>: {PRT-17A X D-150 + Cocopeat : Vermicompost (1:1)}, T<sub>10</sub>: {KP-15C3 X D-150 + Cocopeat : Vermiculite : Vermicompost (2:1:1)}, T<sub>11</sub>: {PSL/76-6 X D-150 + Cocopeat : Vermiculite : Vermicompost (2:1:1)} and T<sub>12</sub>: {PRT-17A X D-150 + Cocopeat : Vermiculite : Vermicompost (2:1:1)}.

Healthy seedlings were transplanted in the main field at 6.0 m x 1.0 m plots at 60 cm spacing between rows and 20 cm between plants. The field crop received a uniform dose of farmyard manure (30 t ha<sup>-1</sup>) along with inorganic fertilizers at 120 kg N, 240 kg P<sub>2</sub>O<sub>5</sub> and 120 kg K<sub>2</sub>O per hectare. Recommended cultural and plant protection measures were followed equally in all the plots when required. The crop was harvested at 90 days after transplanting. Before harvesting, the skin of the tubers was hardened by withholding irrigation for 10 days. After harvest, the tubers were graded according to diameter and weight. Tubers were kept for one week for shade drying to remove field heat and then it was treated in boric acid @ 3 g per litre of water to prevent sprouting. Treated tubers were stored in cold storage at 2-4°C for future use.

The data on different growth parameters like plant height were measured from ground level to the tip of the main shoot with the help of a scale and number of compound leaves per plant was counted at 30, 60 DAT and at harvest. The leaf length, leaf width and leaf area was measured with the help of a leaf area meter and stem diameter was measured with the help of vernier callipers in each tagged five plants from each replication at 30, 60 DAT and at harvest. At the time of harvest, the tuberlets were separated according to their sizes (micro tuber, small tuber, medium tuber and large tuber) with the help of vernier calipers in five randomly selected plants from each replication in each treatment and then their fresh weight of tubers was recorded. The data pertaining to all characters studied were subjected to statistical analysis by using variance techniques as described by Panse and Sukhatme (2000). The treatment differences were tested by the 'F' test of significance based on the null hypothesis. The critical difference was calculated when the difference between the treatments were found significant by the 'F' test at 0.05 level of significance.

## RESULT AND DISCUSSION

### GROWTH PARAMETERS

Experimental results revealed that rapid increase in growth parameters was observed up to 60 DAT and recorded maximum growth rate at 60 DAT and after that the growth rate gradually declined due to senescence, while at harvest it was dried.

Plant height is very important to monitor the overall canopy architecture and also govern the orientation of the leaves that further govern the photosynthetic efficiency of a plant to utilize the natural resources. Pooled data of two seasons (Table 1) revealed that significantly maximum plant height (25.15 cm and 47.61 cm) was recorded in T<sub>1</sub> at 30 and 60 DAT respectively, which was on par with T<sub>4</sub> (24.66 cm at 30 DAT and 46.16 cm at 60 DAT) and T<sub>7</sub> (45.62 cm at 60 DAT). Minimum plant height (14.06 cm and 33.72 cm) was registered in T<sub>8</sub> treatment at 30 and 60 DAT respectively. The highest plant height in T<sub>1</sub> at all growth stages which might be due to maximum seedling height, higher seedling vigor index and more number of true leaves per seedling at the transplant stage which resulted in faster recover from transplant shock which led to good establishment in the field (Govind and Chandra, 1993). These results were supported by the observation of Chatterjee and Mal (2016) in cabbage who found that the seedling received manure like FYM and vermicompost as growth media in the nursery significantly influenced the main crop performance and they concluded that best seedling growth could have enhanced the plant vigor and physiological processes, results in higher metabolic, higher carbohydrate synthesis, faster loading and mobilization of carbohydrates

that ultimately enhanced growth parameters in the main field. Bhardwaj (2013) reported that good physical and biological conditions in cocopeat, FYM and vermicompost had a positive effect on root development which was helpful in increasing the survival percent of seedlings in the main field after transplanting.

Number of compound leaves per plant is an important character, as it is directly linked with the photosynthetic area available to the plant. The data (Table 1) revealed that among the treatments, T<sub>1</sub> was recorded maximum number of compound leaves per plant (15.05 and 28.13) at 30 and 60 DAT respectively, which was followed by T<sub>4</sub> (13.41) at 30 DAT, while it was on par with T<sub>4</sub> (27.44) at 60 DAT and T<sub>7</sub> (27.15) at 60 DAT. Significantly minimum number of compound leaves per plant (7.84 and 19.62) was observed in T<sub>8</sub> at 30 and 60 DAT respectively. Highest values in T<sub>1</sub> could be attributed with a maximum plant height of this treatment which might provide more area for the production of leaves resulted in the increased photosynthetic area (Govind and Chandra, 1993). A similar finding was also obtained by Hazarika *et al.* (2022) in cabbage who reported that the same seedling raised media showed better performance in the main field.

The data from (Table 2) revealed that maximum leaf length (8.85 cm and 20.13 cm) and leaf width (6.68 cm and 14.23 cm) was recorded in T<sub>1</sub> treatment at 30 and 60 DAT respectively, which was on par with T<sub>4</sub> (8.64 cm & 6.50 cm at 30 DAT and 19.95 cm & 14.18 cm at 60 DAT) and T<sub>7</sub> (8.32 cm & 6.47 cm at 30 DAT and 19.86 cm & 14.12 cm at 60 DAT) in leaf length & leaf width respectively. Minimum leaf length (6.28 cm and 15.82 cm) and leaf width (4.08 cm and 11.41 cm) was recorded in T<sub>8</sub> at 30 and 60 DAT respectively. Highest and lowest values of these parameters at all the growth stages might be due to their varietal character, the capacity of root regeneration, their adoptability to different soil and environmental conditions and response to the available nutrients which might influenced the leaf length and width (Singh and Singh, 1973). These results are in close conformity with the findings of Kundu (1998), Jamroet *et al.* (2016) and Beck (2021) in potato.

Leaf area is required for the capture of solar radiation to optimize final tuber yield and dry matter content (Pavek and Thornton, 2009). Data from (Table 3) the highest leaf area was recorded in T<sub>1</sub> (27.94 cm<sup>2</sup> and 51.48 cm<sup>2</sup>) at 30 and 60 DAT respectively, which was on par with T<sub>4</sub> (27.53 cm<sup>2</sup> at 30 DAT and 51.31 cm<sup>2</sup> at 60 DAT), T<sub>7</sub> (27.45 cm<sup>2</sup> at 30 DAT and 51.24 cm<sup>2</sup> at 60 DAT) and T<sub>9</sub> (26.64 cm<sup>2</sup> at 30 DAT and 48.13 cm<sup>2</sup> at 60 DAT). Minimum leaf area (21.51 cm<sup>2</sup> and 40.45 cm<sup>2</sup>) was recorded in T<sub>8</sub> at 30 and 60 DAT respectively. Highest values in T<sub>1</sub> treatment at all the growth stages might be attributed to the same treatment registered the best figures in terms of leaf length and leaf width. Atiyeh *et al.* (2001) suggested that FYM and vermicompost contained good microbial activity and the ability to produce growth regulated materials resulting in an increased leaf surface.

**Table 1: Studies on the field performance of best treatments from the nursery experiment on plant height (cm) and number of compound leaves per plant of TPS method**

Treatments	Plant height (cm)	Number of compound leaves per plant
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	30 DAT			60 DAT			At harvest	30 DAT			60 DAT			At harvest
	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled		2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	
T <sub>1</sub>	26.22	24.07	25.15	50.50	44.73	47.61	Dried	15.60	14.50	15.05	29.35	26.90	28.13	Dried
T <sub>2</sub>	22.54	20.53	21.54	47.00	38.30	42.65	Dried	13.20	11.75	12.48	28.05	22.25	25.15	Dried
T <sub>3</sub>	20.56	19.05	19.81	44.07	36.50	40.29	Dried	10.05	9.40	9.73	25.65	20.78	23.22	Dried
T <sub>4</sub>	25.62	23.70	24.66	50.29	42.04	46.16	Dried	14.00	12.82	13.41	29.08	25.80	27.44	Dried
T <sub>5</sub>	22.49	20.45	21.47	46.87	37.75	42.31	Dried	11.20	10.61	10.90	27.76	21.97	24.87	Dried
T <sub>6</sub>	22.41	20.40	21.40	44.28	37.56	40.92	Dried	10.50	9.90	10.20	25.78	21.40	23.59	Dried
T <sub>7</sub>	23.91	22.30	23.10	49.58	41.67	45.62	Dried	13.90	12.70	13.30	28.60	25.70	27.15	Dried
T <sub>8</sub>	15.09	13.03	14.06	37.75	29.68	33.72	Dried	8.56	7.12	7.84	23.00	16.25	19.62	Dried
T <sub>9</sub>	22.77	21.15	21.96	47.21	39.00	43.11	Dried	13.70	12.50	13.10	28.30	24.00	26.15	Dried
T <sub>10</sub>	17.22	15.07	16.15	39.00	30.56	34.78	Dried	9.02	7.73	8.38	23.20	17.39	20.30	Dried
T <sub>11</sub>	19.86	18.06	18.96	42.50	34.58	38.54	Dried	9.60	8.50	9.05	25.36	19.38	22.37	Dried
T <sub>12</sub>	17.53	16.12	16.82	41.50	31.18	36.34	Dried	9.40	8.03	8.72	25.17	18.12	21.65	Dried
CD (P=0.05) Treatments	3.03	2.73	1.92	4.97	4.29	3.09	-	1.33	1.50	0.94	2.94	2.39	1.78	-
CD (P=0.05) Years			0.78			1.26				0.39			0.73	
SEm Treatments ±	0.97	0.88	0.66	1.60	1.38	1.05	-	0.43	0.48	0.32	0.94	0.77	0.61	-
SEm ± Years			0.27			0.43				0.13			0.25	
CV	6.44	6.37	6.42	5.02	5.27	5.15	-	5.24	6.51	5.85	5.01	5.01	5.04	-

**Table 2: Studies on the field performance of best treatments from the nursery experiment on leaf length (cm) and leaf width (cm) of TPS method**

Treatments	Leaf length (cm)							Leaf width (cm)						
	30 DAT			60 DAT			At harvest	30 DAT			60 DAT			At harvest
	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled		2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	
T <sub>1</sub>	9.22	8.48	8.85	20.75	19.50	20.13	Dried	6.88	6.49	6.68	14.51	13.95	14.23	Dried
T <sub>2</sub>	7.83	7.61	7.72	18.35	17.25	17.80	Dried	5.99	5.66	5.82	13.13	12.75	12.94	Dried
T <sub>3</sub>	7.45	7.18	7.31	17.50	16.25	16.88	Dried	5.70	5.22	5.46	11.99	11.62	11.80	Dried
T <sub>4</sub>	8.97	8.32	8.64	20.50	19.39	19.95	Dried	6.71	6.29	6.50	14.47	13.89	14.18	Dried
T <sub>5</sub>	7.77	7.54	7.65	18.33	17.00	17.67	Dried	5.90	5.60	5.75	13.11	12.73	12.92	Dried
T <sub>6</sub>	7.62	7.35	7.48	17.77	16.90	17.33	Dried	5.81	5.35	5.58	12.05	11.66	11.86	Dried
T <sub>7</sub>	8.45	8.19	8.32	20.47	19.25	19.86	Dried	6.69	6.25	6.47	14.40	13.85	14.12	Dried
T <sub>8</sub>	6.51	6.05	6.28	16.90	14.74	15.82	Dried	4.29	3.87	4.08	11.69	11.12	11.41	Dried
T <sub>9</sub>	7.96	7.88	7.92	18.60	17.42	18.01	Dried	6.00	5.71	5.86	13.18	12.85	13.02	Dried
T <sub>10</sub>	6.90	6.92	6.91	17.00	15.09	16.05	Dried	4.33	4.00	4.17	11.82	11.34	11.58	Dried
T <sub>11</sub>	7.22	6.89	7.05	17.42	16.00	16.71	Dried	5.67	5.19	5.43	11.93	11.56	11.75	Dried
T <sub>12</sub>	7.06	6.72	6.89	17.25	15.45	16.35	Dried	5.56	5.10	5.33	11.89	11.52	11.71	Dried
CD (P=0.05) for Treatments	1.04	1.08	0.71	2.49	2.29	1.60	-	1.07	1.02	0.69	1.42	1.63	1.02	-
CD (P=0.05) for Years			0.29			0.65				0.28			0.42	
SEm ± for Treatments	0.33	0.35	0.24	0.80	0.74	0.54	-	0.34	0.33	0.24	0.46	0.53	0.35	-
SEm ± for Years			0.10			0.22				0.10			0.14	
CV	6.09	6.63	6.35	6.16	6.11	6.14	-	8.36	8.56	8.46	5.03	5.99	5.51	-

**Table 3: Studies on the field performance of best treatments from the nursery experiment on leaf area (cm<sup>2</sup>) and stem diameter (cm) of TPS method**

Treatments	Leaf area (cm <sup>2</sup> )						Stem diameter (cm)							
	30 DAT			60 DAT			At harvest	30 DAT			60 DAT			At harvest
	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled		2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	
T <sub>1</sub>	28.38	27.50	27.94	53.30	49.66	51.48	Dried	0.66	0.54	0.60	0.85	0.79	0.82	Dried
T <sub>2</sub>	26.63	24.82	25.73	48.14	47.19	47.66	Dried	0.48	0.38	0.43	0.75	0.68	0.72	Dried
T <sub>3</sub>	23.19	22.62	22.90	45.25	43.25	44.25	Dried	0.38	0.29	0.33	0.66	0.59	0.63	Dried
T <sub>4</sub>	28.30	26.75	27.53	53.28	49.34	51.31	Dried	0.65	0.53	0.59	0.83	0.77	0.80	Dried
T <sub>5</sub>	26.52	24.61	25.56	48.00	46.25	47.13	Dried	0.47	0.36	0.41	0.74	0.66	0.70	Dried
T <sub>6</sub>	23.25	23.00	23.12	45.31	44.43	44.87	Dried	0.39	0.30	0.34	0.68	0.60	0.64	Dried
T <sub>7</sub>	28.27	26.63	27.45	53.23	49.25	51.24	Dried	0.62	0.52	0.57	0.81	0.76	0.79	Dried
T <sub>8</sub>	22.03	20.98	21.51	41.13	39.76	40.45	Dried	0.28	0.21	0.25	0.49	0.42	0.46	Dried
T <sub>9</sub>	26.75	26.52	26.64	48.25	48.00	48.13	Dried	0.50	0.41	0.46	0.77	0.68	0.73	Dried
T <sub>10</sub>	22.15	21.45	21.80	41.98	40.42	41.20	Dried	0.30	0.25	0.28	0.54	0.48	0.51	Dried
T <sub>11</sub>	23.14	22.09	22.62	44.91	42.68	43.80	Dried	0.36	0.29	0.33	0.64	0.55	0.60	Dried
T <sub>12</sub>	23.06	22.00	22.53	44.36	41.88	43.12	Dried	0.33	0.27	0.30	0.61	0.53	0.57	Dried
CD (P=0.05) for Treatments	2.84	2.69	1.84	5.30	4.99	3.43	-	0.09	0.08	0.06	0.12	0.12	0.07	-
CD (P=0.05) for Years			0.75			1.40				0.02			0.03	
SEm ± for Treatments	0.91	0.87	0.63	1.70	1.60	1.17	-	0.03	0.02	0.02	0.04	0.03	0.03	-
SEm ± for Years			0.26			0.48				0.01			0.01	
CV	5.13	5.08	5.11	5.09	5.02	5.06	-	9.49	9.76	9.65	7.56	7.80	7.68	-

T<sub>1</sub>: KP-15C3 X D-150 + Cocopeat : Vermicompost :FYM (2:1:1)

T<sub>3</sub>: PRT-17A X D-150 + Cocopeat : Vermicompost :FYM (2:1:1)

T<sub>5</sub>: PSL/76-6 X D-150 + Cocopeat : FYM (1:1)

T<sub>7</sub>: KP-15C3 X D-150 + Cocopeat : Vermicompost (1:1)

T<sub>9</sub>: PRT-17A X D-150 + Cocopeat : Vermicompost (1:1)

T<sub>11</sub>: PSL/76-6 X D-150 + Cocopeat : Vermiculite : Vermicompost (2:1:1)

T<sub>2</sub>: PSL/76-6 X D-150 + Cocopeat + Vermicompost: FYM (2:1:1)

T<sub>4</sub>: KP-15C3 X D-150 + Cocopeat : FYM (1:1)

T<sub>6</sub>: PRT-17A X D-150 + Cocopeat : FYM (1:1)

T<sub>8</sub>: PSL/76-6 X D-150 + Cocopeat : Vermicompost (1:1)

T<sub>10</sub>: KP-15C3 X D-150 + Cocopeat :Vermiculite :Vermicompost (2:1:1)

T<sub>12</sub>: PRT-17A X D-150 + Cocopeat :Vermiculite:Vermicompost (2:1:1)

Stem diameter is one of the most important parameters for the transportation of water, nutrients and other internal fluids from the roots to the leaves and the flow of photosynthates from source to sink (Wien, 1997). The data from (Table 3) maximum stem diameter (0.60 cm and 0.82 cm) was recorded in T<sub>1</sub> at 30 and 60 DAT respectively, which was on par with T<sub>4</sub> (0.59 cm at 30 DAT and 0.80 cm at 60 DAT) and T<sub>7</sub> (0.57 cm at 30 DAT and 0.79 at 60 DAT). The minimum stem diameter (0.25 cm and 0.46 cm) was observed in T<sub>8</sub> at 30 and 60 DAT respectively. The maximum values in T<sub>1</sub> might be positively correlated with plant height, as plant height was increased automatically the stem diameter was also increased (Vivek and Duraisamy, 2017) and it also might be positively correlated with number of compound leaves (Borah *et al.*, 2008). A similar finding was also obtained by Hazarika *et al.* (2022) in cabbage who reported that the same seedling raised media showed better performance like plant height, leaf area and stem diameter in the main field. These results are also in agreement with the findings of Gholamnejadet *al.* (2012), Nasirabadet *al.* (2012) in sweet pepper and Vivek and Duraisamy (2017) in tomato.

## YIELD PARAMETERS

The results from (Table 4) showed that T<sub>1</sub> was recorded a significantly maximum number of tubers per plant viz., micro tubers (11.77), small tubers (7.46), medium tubers (5.89) and large tubers (2.84), which was on par with T<sub>4</sub> (11.26, 6.93 and 2.79) and T<sub>7</sub> (11.17, 6.90 and 2.73) in microtubers, small tubers and large tubers respectively, while it

was followed by T<sub>4</sub> (5.04) in medium tubers. The minimum number of tubers per plant viz., microtubers (9.13), small tubers (5.02), medium tubers (2.74) and large tubers (1.29) was recorded in T<sub>8</sub>.

The data from (Table 4) treatment T<sub>1</sub> has recorded a significantly maximum number of tubers per plant like micro tubers, small tubers, medium tubers and large tubers might be attributed to good root regeneration, thus resulting in more vigorous plant morphological growth like plant height, number of compound leaves per plant and leaf area with more effective physiological processes such as photosynthesis, With effective photosynthesis, more carbohydrates could have been produced and has promoted more initiation of stolons per hill and bulking as well as environmental factors that caused differences in the size of tubers (Patel *et al.*, 2002). Pavék and Thornton (2009) reported that the number of tubers per plant might be influenced by weather conditions as well as morphological characters. Gebremedhin *et al.* (2013) who concluded that the number of tubers among the cultivars could be genetic. The same trend was found by Nizamuddin *et al.* (2010), Moeini *et al.* (2011), Bilate and Mulualem (2016) and Jamroet *et al.* (2016) in potato.

The results from (Table 5) showed that T<sub>1</sub> was recorded a significantly maximum fresh weight of tubers per plant viz., micro tubers (16.21 g), small tubers (44.03 g), medium tubers (171.40 g) and large tubers (115.28 g), which was on par with T<sub>4</sub> (16.10 g, 41.27 g, 168.21 g and 108.08 g) in all above tubers respectively, T<sub>7</sub> (15.38 g in micro tubers and 159.87 g in medium tubers) and T<sub>9</sub> (15.31 g) in microtubers. The minimum fresh weight of tubers per plant viz., micro tubers (11.15 g), small tubers (26.03 g), medium tubers (88.24 g) and large tubers (50.28 g) was recorded in T<sub>8</sub>. The variation in weight of tubers might be due to heredity and adaptability or establishment effect of other growth attributes like plant height, leaf number which might influenced differently on different varieties. Tekalign (2003) reported that yield differences among varieties were attributed to the inherent yield potential of varieties and growing environment as well as the interaction of varieties x environment in potato. It also might be due to better growth of the above ground parts which led to more photosynthetic formation and their translocation in the sink (tuber) resulted in higher yield (Diengdohet *et al.*, 2012). This result is in agreement with the finding of Muthuraj *et al.* (2005), Asmamawu (2007), Elfinesh (2008), Patel *et al.* (2008), Cioloca *et al.* (2012), Gebreselassie *et al.* (2016), Jamroet *et al.* (2016) and Beck (2021) in potato.

**Table 4: Studies on the field performance of best treatments from the nursery experiment on number of micro, small, medium and large tubers per plant of TPS method**

Treatments	Number of micro tubers per plant			Number of small tubers per plant			Number of medium tubers per plant			Number of large tubers per plant		
	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled
T <sub>1</sub>	11.72	11.81	11.77	7.45	7.47	7.46	6.39	5.39	5.89	3.43	2.25	2.84
T <sub>2</sub>	10.01	10.15	10.08	6.58	6.61	6.59	4.51	3.88	4.19	2.25	1.45	1.85
T <sub>3</sub>	9.82	10.00	9.91	6.55	6.59	6.57	4.12	3.61	3.86	2.08	1.08	1.58
T <sub>4</sub>	11.19	11.33	11.26	6.84	7.02	6.93	5.58	4.50	5.04	3.39	2.19	2.79
T <sub>5</sub>	10.02	10.22	10.12	6.38	6.39	6.38	4.32	3.82	4.07	2.17	1.28	1.72
T <sub>6</sub>	9.61	10.01	9.81	6.26	6.24	6.25	4.22	3.71	3.96	2.10	1.11	1.60
T <sub>7</sub>	11.02	11.31	11.17	6.80	7.01	6.90	5.21	4.15	4.68	3.33	2.13	2.73

T <sub>8</sub>	8.89	9.37	9.13	4.95	5.10	5.02	3.25	2.23	2.74	1.88	0.70	1.29
T <sub>9</sub>	10.32	10.54	10.43	6.59	6.72	6.65	5.06	4.03	4.54	2.29	1.75	2.02
T <sub>10</sub>	8.94	9.46	9.20	5.05	5.63	5.34	3.42	2.40	2.91	1.93	0.82	2.07
T <sub>11</sub>	9.63	10.01	9.82	6.11	6.19	6.15	3.92	3.39	3.65	2.03	1.01	1.37
T <sub>12</sub>	9.20	9.93	9.56	6.02	6.15	6.08	3.81	3.28	3.54	1.98	0.98	1.52
CD (P=0.05) for Treatments	1.57	1.29	0.95	1.12	1.11	0.74	1.21	1.00	0.74	1.00	0.56	0.54
CD (P=0.05) for Years			NS			NS			0.30			0.22
SEm ± for Treatments	0.50	0.41	0.33	0.36	0.36	0.25	0.39	0.32	0.25	0.32	0.18	0.18
SEm ± for Years			0.13			0.10			0.10			0.08
CV	7.10	5.64	6.39	8.08	7.83	7.96	12.24	12.31	12.33	18.99	18.25	19.45

Note: microtubers (1-9 mm), small tubers (10-19 mm), medium tubers (20-39 mm) and large tubers (>40 mm)

**Table 5: Studies on the field performance of best treatments from the nursery experiment on fresh weight of micro, small, medium and large tubers per plant of TPS method**

Treatments	Fresh weight of micro tubers per plant (g)			Fresh weight of small tubers per plant (g)			Fresh weight of medium tubers per plant (g)			Fresh weight of large tubers per plant (g)		
	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled
T <sub>1</sub>	16.07	16.34	16.21	43.83	44.24	44.03	182.80	160.00	171.40	121.06	109.50	115.28
T <sub>2</sub>	12.63	12.96	12.79	32.50	32.89	32.69	142.00	129.79	135.90	94.46	78.21	86.33
T <sub>3</sub>	12.78	13.00	12.89	30.01	30.25	30.13	116.44	97.28	106.86	76.36	57.30	66.83
T <sub>4</sub>	15.97	16.23	16.10	41.10	41.44	41.27	179.61	156.81	168.21	118.00	98.16	108.08
T <sub>5</sub>	13.05	13.63	13.34	29.45	29.82	29.63	130.00	127.75	128.88	93.00	69.00	81.00
T <sub>6</sub>	12.43	12.87	12.65	28.10	28.35	28.22	118.45	105.45	111.95	77.44	58.10	67.77
T <sub>7</sub>	15.29	15.48	15.38	38.45	38.91	38.68	170.87	148.87	159.87	115.00	96.09	105.55
T <sub>8</sub>	10.91	11.39	11.15	25.67	26.38	26.03	98.98	77.50	88.24	61.00	39.56	50.28
T <sub>9</sub>	15.21	15.41	15.31	32.85	33.16	33.00	158.50	138.12	148.31	102.40	82.56	92.48
T <sub>10</sub>	11.81	12.11	11.96	25.89	26.39	26.14	100.50	80.07	90.28	64.84	45.46	55.15
T <sub>11</sub>	12.36	12.45	12.40	26.61	27.18	26.89	110.87	88.28	99.57	71.00	52.13	61.57
T <sub>12</sub>	12.04	12.39	12.21	26.06	26.44	26.25	109.45	82.87	96.16	69.00	48.50	58.75
CD (P=0.05) for Treatments	1.55	1.61	1.05	3.82	4.09	2.64	16.33	18.30	11.56	9.86	9.18	6.35
CD (P=0.05) for Years			NS			NS			4.72			2.59
SEm ± for Treatments	0.50	0.52	0.36	1.23	1.31	0.90	5.25	5.88	3.94	3.17	2.95	2.16
SEm ± for Years			0.15			0.37			1.61			0.88
CV	5.27	5.35	5.31	5.47	5.78	5.63	5.50	7.16	6.28	5.06	6.00	5.47

Note: microtubers (1-9 mm), small tubers (10-19 mm), medium tubers (20-39 mm) and large tubers (> 40 mm)

T<sub>1</sub>: KP-15C3 X D-150 + Cocopeat : Vermicompost :FYM (2:1:1)

T<sub>3</sub>: PRT-17A X D-150 + Cocopeat : Vermicompost :FYM (2:1:1)

T<sub>5</sub>: PSL/76-6 X D-150 + Cocopeat : FYM (1:1)

T<sub>7</sub>: KP-15C3 X D-150 + Cocopeat : Vermicompost (1:1)

T<sub>9</sub>: PRT-17A X D-150 + Cocopeat : Vermicompost (1:1)

T<sub>11</sub>: PSL/76-6 X D-150 + Cocopeat : Vermiculite : Vermicompost (2:1:1)

T<sub>2</sub>: PSL/76-6 X D-150 + Cocopeat + Vermicompost: FYM (2:1:1)

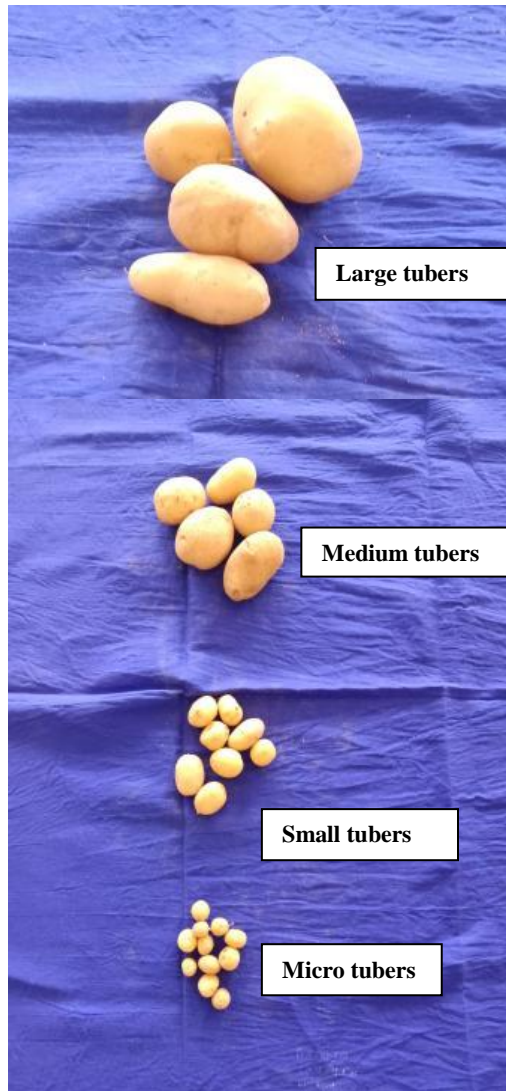
T<sub>4</sub>: KP-15C3 X D-150 + Cocopeat : FYM (1:1)

T<sub>6</sub>: PRT-17A X D-150 + Cocopeat : FYM (1:1)

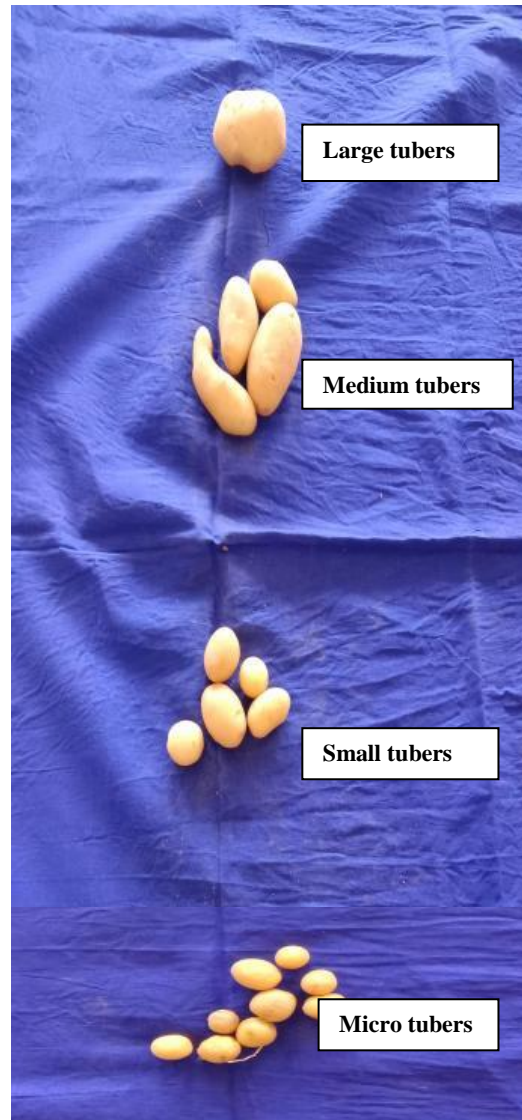
T<sub>8</sub>: PSL/76-6 X D-150 + Cocopeat : Vermicompost (1:1)

T<sub>10</sub>: KP-15C3 X D-150 + Cocopeat :Vermiculite :Vermicompost (2:1:1)

T<sub>12</sub>: PRT-17A X D-150 + Cocopeat :Vermiculite:Vermicompost (2:1:1)



Tuber yield per plant in  $T_1$  treatment



Tuber yield per plant in  $T_8$  treatment

Fig. 1: Comparison of tuber yield per plant in highest ( $T_1$ ) and lowest ( $T_8$ ) treatment

**Table 6: Studies on the field performance of best treatments from the nursery experiment on total number of tubers, tuber yield per plant, plot and hectare of TPS method**

Treatments	Total number of tubers per plant			Tuber yield (g/plant)			Tuber yield per plot (kg/6 m <sup>2</sup> )			Tuber yield (t/ha)		
	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled	2021-22 (Rabi)	2022-23 (Rabi)	Pooled
T <sub>1</sub>	28.98	26.92	27.95	363.76	330.08	346.92	21.83	19.81	20.82	36.38	33.01	34.69
T <sub>2</sub>	23.34	22.09	22.71	281.58	253.85	267.71	16.90	15.23	16.06	28.16	25.38	26.77
T <sub>3</sub>	22.57	21.27	21.92	235.58	197.82	216.70	14.14	11.87	13.00	23.56	19.79	21.67
T <sub>4</sub>	26.99	25.03	26.01	354.67	312.62	333.65	21.28	18.76	20.02	35.47	31.27	33.37
T <sub>5</sub>	22.88	21.70	22.29	265.50	240.19	252.85	15.93	14.42	15.17	26.55	24.03	25.29
T <sub>6</sub>	22.18	21.06	21.62	236.41	204.76	220.59	14.19	12.29	13.24	23.64	20.48	22.06
T <sub>7</sub>	26.36	24.60	25.48	339.60	299.35	319.47	20.38	17.97	19.17	33.96	29.95	31.95
T <sub>8</sub>	18.96	17.39	18.17	196.56	154.83	175.69	11.80	9.29	10.54	19.66	15.49	17.57
T <sub>9</sub>	24.25	23.04	23.65	308.95	269.24	289.09	18.54	16.15	17.34	30.89	26.92	28.90
T <sub>10</sub>	19.33	18.31	18.82	203.03	164.02	183.53	12.18	9.85	11.01	20.30	16.41	18.35
T <sub>11</sub>	21.67	20.60	21.13	220.83	180.03	200.43	13.25	10.80	12.03	22.09	18.00	20.04
T <sub>12</sub>	20.99	20.34	20.67	216.54	170.20	193.37	12.99	10.22	11.60	21.65	17.03	19.34
CD (P=0.05) for Treatments	3.10	2.13	1.77	22.30	20.19	14.17	1.33	1.22	0.85	2.22	2.03	1.42
CD (P=0.05) for Years			0.72			5.79			0.35			0.58
SEm ± for Treatments	1.00	0.68	0.60	7.16	6.49	4.83	0.43	0.39	0.29	0.72	0.65	0.48
SEm ± for Years			0.25			1.97			0.12			0.20
CV	6.07	4.43	5.36	3.77	3.96	3.87	3.76	3.98	3.87	3.76	3.98	3.87

T<sub>1</sub>: KP-15C3 X D-150 + Cocopeat : Vermicompost : FYM (2:1:1)

T<sub>3</sub>: PRT-17A X D-150 + Cocopeat : Vermicompost : FYM (2:1:1)

T<sub>5</sub>: PSL/76-6 X D-150 + Cocopeat : FYM (1:1)

T<sub>7</sub>: KP-15C3 X D-150 + Cocopeat : Vermicompost (1:1)

T<sub>9</sub>: PRT-17A X D-150 + Cocopeat : Vermicompost (1:1)

T<sub>11</sub>: PSL/76-6 X D-150 + Cocopeat : Vermiculite : Vermicompost (2:1:1)

T<sub>2</sub>: PSL/76-6 X D-150 + Cocopeat + Vermicompost: FYM (2:1:1)

T<sub>4</sub>: KP-15C3 X D-150 + Cocopeat : FYM (1:1)

T<sub>6</sub>: PRT-17A X D-150 + Cocopeat : FYM (1:1)

T<sub>8</sub>: PSL/76-6 X D-150 + Cocopeat : Vermicompost (1:1)

T<sub>10</sub>: KP-15C3 X D-150 + Cocopeat : Vermiculite : Vermicompost (2:1:1)

T<sub>12</sub>: PRT-17A X D-150 + Cocopeat : Vermiculite: Vermicompost (2:1:1)

The data from (Table 6) revealed that a significantly maximum number of total tubers per plant (27.95), tuber yield per plant (346.92 g), tuber yield per plot (20.82 kg) and tuber yield (34.69 t/ha) was recorded in T<sub>1</sub>, which was followed by T<sub>4</sub> (26.01) in total number of tubers per plant, while it was on par with T<sub>4</sub> (333.65 g, 20.02 kg and 33.37 t/ha) in tuber yield per plant, tuber yield per plot and tuber yield per hectare. The minimum number of total tubers per plant (18.17), tuber yield per plant (175.69 g), tuber yield per plot (10.54 kg) and tuber yield (17.57 t/ha) was recorded in T<sub>8</sub>. The highest number of tuber per plant and their fresh weight in T<sub>1</sub> treatment could be attributed to the maximum number of micro tubers, small tubers, medium tubers and large tubers per plant and their fresh weight of this treatment. The highest tuber yield per plot could be attributed to the maximum tuber yield per plant of this treatment as compared to other treatments. This result is in agreement with the finding of Badr *et al.* (2012) who stated that tuber number and

tuber weight per plant jointly increased tuber yield per plot. This finding was in close conformity with the results of Beck (2021) in potato.

Lower tuber yield in T<sub>8</sub> treatment might be due to slow growth and development it might possible that tuber initiation was reduced and this finally resulted into poor tuber yield (Burton, 1980).

## CONCLUSION

The result of the field experiment of true potato seed revealed that KP-15C3 X D-150 + Cocopeat : Vermicompost : FYM (2:1:1) was recorded significantly highest values for growth parameters in terms of plant height, number of compound leaves per plant, leaf area and stem diameter with highest tuberlet yield. It can conclude that successfully tuberlets yield can be produced from seedling raised from TPS.

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